REMARKS

Claims 12-30 are pending in this application. Claims 12 and 24-30 have been amended. No new matter has been introduced.

At the outset, Applicant notes that notes that the limitations "a plasma enhanced chemical vapor deposition hydrogenation process-treated and subsequently nitrogen infusion process-treated current emission surface" (claim 24), "an atomic concentration of oxygen resulting from treatment of the current emission surface with a silane gas followed by an ammonia gas," (claim 26), "a reduced atomic concentration of oxygen" (claim 27) that result from exposing the current emitter to the hydrogenation and nitrogen infusion process of the claimed invention are not product-by-process limitations, as the last Office Action asserts, but rather *resulting structures* having defined and distinct characteristics.

In R2 Medical Systems, Inc. v. Katecho, Inc., which involved a claim reciting that one element be "affixed" to another, the court found that "'affixed' means 'to be attached physically.'" R2 Medical Systems, Inc. v. Katecho, Inc., 931 F.Supp. 1397, 1425-26 (N.D. Ill. 1996). The Court held that "[t]he terms of the claims do not indicate that 'affixed' refers to a process by which the stannous chloride is bound to the conductive plate, but only that it refers to the result of that process." Id. (quoting CVI/Beta Ventures, Inc. v. Custom Optical Frames, Inc., 893 F. Supp. 508, 519 (D. Md. 1995) (limitation that element be in 'work-hardened pseudoelastic metallurgic state' is directed to the structure, not the process, of manufacture)).

In Hazani v. U.S. Int'l Trade Comm'n, which involved patent claims to a memory cell comprising a conductive plate having a surface that was "chemically engraved," the Federal Circuit also held that the claims were "pure product claims" and not product-by-process claims. Hazani v. U.S. Int'l Trade Comm'n, 126 F.3d 1473, 44 USPQ2d 1358 (Fed. Cir. 1997). The Federal Circuit reasoned that the "chemically engraved" limitation, read in context, described the product more by its structure rather

than by the process used to obtain it. Id.

In the present case, the above-noted limitations of independent claims 24, 26 and 27 are structural limitations and not product-by-process limitations. Like the "chemically engraved" plate of Hazani, a "treated current emission surface" having reduced concentration of native oxides and reduced concentration of oxygen are *resulting structures* having distinct and defined characteristics.

Claims 12-27 stand rejected under 35 U.S.C. § 112, second paragraph, as being "indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention." Specifically, the phrases "having a reduced atomic concentration of oxygen" (claims 12, 26, 27), "having a reduced atomic concentration of native oxides" (claim 24) and "having a reduced atomic concentration of oxygen and silicon" (claim 25) render the claims indefinite. (Office Action at 3). Claims 12 and 24-30 been amended to clarify that the reduced atomic concentration of oxygen, silicon or native oxides of the treated current emission surface is smaller than the atomic concentration of oxygen, silicon or native oxides of the current emission surface subjected to atmospheric conditions. Applicant submits that all pending claims are now in full compliance with 35 U.S.C. § 112.

Claims 24-29 stand rejected under 35 U.S.C. §102(b) as being anticipated by Cathey et al. (U.S. Patent No. 5,853,492) ("Cathey '492"). This rejection is respectfully traversed.

The claimed invention relates to a field emission display device. As such, amended independent claim 24 recites a "field emission display device" comprising *inter alia* "at least one current emitter formed of a doped silicon" and "a substrate having a phosphor coating on at least a portion of the substrate . . . said current emitter comprising a plasma enhanced chemical vapor deposition hydrogenation process-treated and subsequently nitrogen infusion process-treated current emission surface." Amended independent claim 24 also recites that the current emission surface has a "concentration of

native oxides which is smaller than the concentration of native oxides of the current emission surface subjected to atmospheric conditions."

Independent claim 26 recites a "field emission display device" comprising "at least one current emitter formed of a doped silicon" and "a substrate having a phosphor coating in at least one region positioned to receive electrons emitted by said current emitter." Independent claim 26 also recites that the current emitter comprises "a treated current emission surface having a reduced atomic concentration of oxygen resulting from treatment of the current emission surface with a silane gas followed by an ammonia gas."

Amended independent claim 27 recites a "field emission display device" comprising "at least one current emitter formed of a doped silicon" and "a substrate having a phosphor coating in at least one region positioned to receive electrons emitted by said current emitter." Amended independent claim 27 also recites that the current emitter comprises "a treated current emission surface having a reduced atomic concentration of oxygen which is smaller than the atomic concentration of oxygen of the current emission surface subjected to atmospheric conditions." Amended independent claim 27 further recites that the treated current emission surface having the reduced atomic concentration of oxygen is "formed by: (a) exposing at least a portion of said at least one current emitter to a hydrogenation process; and (b) exposing at least a portion of said at least one current emitter to a nitrogen infusion process."

Amended independent claim 28 recites a "field emission display device" comprising "at least one current emitter formed of a doped silicon" and "a substrate having a phosphor coating in at least one region positioned to receive electrons emitted by said current emitter." Amended independent claim 28 also recites that the current emitter comprises "a treated current emission surface . . . having an atomic concentration of oxygen smaller than the atomic concentration of oxygen of the current emission surface subjected to atmospheric conditions."

Amended independent claim 29 recites a "field emission display device" comprising "at least one current emitter formed of a doped silicon" and "a substrate having

a phosphor coating . . . said current emitter comprising a treated current emission surface." Amended independent claim 29 also recites that the treated current emission surface has "an atomic concentration of silicon smaller than the atomic concentration of silicon of the current emission surface subjected to atmospheric conditions."

Cathey '492 relates to a "wet chemical process . . . for treating an emitter formed on a substrate of a field emission display." (Abstract). According to Cathey '492, "the process comprises applying a solution . . . of hydrofluoric acid to the emitter." (Abstract).

Cathey '492 does not disclose all limitations of independent claims 24 and 26-29. Cathey '492 does not disclose a "field emission display device" comprising "at least one current emitter formed of a doped silicon," as amended independent claims 24 and 26-29 recite. Cathey '492 teaches only emitters 202a-202n formed over substrate 200 and subjected to a solution 204 including hydrogen. (Col. 2, lines 27-31). Cathey '492 is silent, however, about "at least one current emitter formed of a doped silicon," as in the claimed invention. Cathey '492 also fails to disclose a current emitter comprising "a plasma enhanced chemical vapor deposition hydrogenation process-treated and subsequently nitrogen infusion process-treated current emission surface" (claim 24) or "a treated current emission surface having a reduced atomic concentration of oxygen resulting from treatment of the current emission surface with a silane gas followed by an ammonia gas" (claim 26). Cathey '492 relates to a wet chemical process for applying a solution of hydrofluoric acid to the emitter, and not to current emitter having enhanced properties as a result of the hydrogenation and nitrogen infusion process of the claimed invention.

Cathey '492 also fails to disclose that the treated current emission surface having the reduced atomic concentration of oxygen is "formed by: (a) exposing at least a portion of said at least one current emitter to a hydrogenation process; and (b) exposing at least a portion of said at least one current emitter to a nitrogen infusion process" (claim 27) or that the treated current emission surface has "an atomic concentration of silicon smaller than the atomic concentration of silicon of the current emission surface subjected to

atmospheric conditions" (claim 29). For at least these reasons, Cathey '492 fails to anticipate the subject matter of claims 24-29 and withdrawal of the rejection of these claims is respectfully requested.

Claim 30 stands rejected under 35 U.S.C. §102(e) as being anticipated by Sandhu et al. (U.S. Patent No. 6,086,442) ("Sandhu"). This rejection is respectfully traversed.

Amended independent claim 30 recites a "field emission display device" comprising "at least one current emitter formed of a doped silicon" and "a substrate having a phosphor coating in at least one region positioned to receive electrons emitted by said current emitter, said current emitter comprising a treated current emission surface." Amended independent claim 30 also recites that the treated current emission surface has "an atomic concentration of nitrogen greater than the atomic concentration of nitrogen of the current emission surface subjected to atmospheric conditions." Amended independent claim 30 further recites that the current emitter further comprises sides, "at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides."

Sandhu relates to methods of forming field emission devices. According to Sandhu, "a method of forming a field emission device includes forming an electron emission substrate comprising emitters and an electrically conductive extraction grid formed outwardly of the emitters." (Abstract). Sandhu also teaches that "[a]n electrically conductive layer is substantially selectively deposited over the grid and emitters relative to the insulative mass" and that "[a]fter the depositing, the electron emission substrate is joined with an electron collector substrate." (Abstract).

Sandhu fails to disclose all limitations of amended independent claim 30. Sandhu fails to teach or suggest that the current emitter comprises sides, "at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides," as amended independent claim 30 recites. In Sandhu, emitter 48, which would arguably correspond to the current emitter of the claimed invention, is "provided in

electrical connection with layer 46" which is formed of "semiconductive material 46 (or other conductive material)" (col. 2, lines 14-21), and not "comprising sides, at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides," as in the claimed invention. For at least these reasons, Sandhu fails to anticipate the subject matter of claim 30 and withdrawal of the rejection of this claim is respectfully requested.

Claims 12, 18 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cathey '492 in view of Jones et al. (U.S. Patent No. 5,371,431) ("Jones"). This rejection is respectfully traversed.

Amended independent claim 12 recites a "field emission display device" comprising "at least one current emitter formed of a doped silicon" and "a treated current emission surface having an atomic concentration of oxygen resulting from treatment of the current emission surface with a plasma enhanced chemical vapor deposition hydrogenation process in the presence of a silane gas followed by a nitrogen infusion process." Amended independent claim 12 also recites that the atomic concentration of oxygen is "smaller than the atomic concentration of oxygen of the current emitter subjected to atmospheric conditions." Amended independent claim 12 further recites that the current emitter further comprises "sides, at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides."

Jones relates to a "vertical microelectronic field emitter" that includes "a conductive top portion and a resistive bottom portion in an elongated column which extends vertically from a horizontal substrate." (Abstract). According to Jones, "[a]n emitter electrode may be formed at the base of the column, and an extraction electrode may be formed adjacent the top of the column" so that "[t]he elongated column reduces the parasitic capacitance of the microelectronic field emitter to provide high speed operation, while providing uniform column-to-column resistance." (Abstract). Jones also teaches that "[t]he field emitter may be formed by first forming tips on the face of a

substrate and then forming trenches in the substrate around the tips to form columns in the substrate, with the tips lying on top of the columns." (Abstract).

The subject matter of claims 12, 18 and 19 would not have been obvious over Cathey '492 and Jones. Specifically, the Office Action fails to establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three requirements must be met: (1) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine reference teachings; (2) a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. M.P.E.P. § 2142. See, e.g., In re Royka, 490 F.2d 981 (CCPA 1974).

First, Cathey '492 and Jones, whether considered alone or in combination, fail to teach or suggest all limitations of claim 12. Neither Cathey '492 nor Jones teaches or suggests a "field emission display device" comprising "at least one current emitter formed of a doped silicon," as amended independent claim 12 recites. Cathey '492 teaches emitters 202a-202n formed over substrate 200 and subjected to a solution 204 including hydrogen (col. 2, lines 27-31), and not "formed of a doped silicon," as in the claimed invention. Jones teaches that emitter tips 15a-15d are formed over a substrate 11 by either a "tips first" method or a "columns first" method, and not that the current emitters are "formed of a doped silicon."

Cathey '492 and Jones, alone or in combination, also fail to teach or suggest "a treated current emission surface having an atomic concentration of oxygen resulting from treatment of the current emission surface with a plasma enhanced chemical vapor deposition hydrogenation process in the presence of a silane gas followed by a nitrogen infusion process," as amended independent claim 12 recites. Cathey '492 relates to a wet chemical process for applying a solution of hydrofluoric acid to the emitter, and not to current emitter having reduced atomic oxygen as a result of the hydrogenation and nitrogen infusion process of the claimed invention. Jones is silent about any "treated current emission surface" of an emitter, much less about "a treated current emission

surface having an atomic concentration of oxygen resulting from treatment of the current emission surface with a plasma enhanced chemical vapor deposition hydrogenation process in the presence of a silane gas followed by a nitrogen infusion process," as in the claimed invention.

Cathey '492 and Jones, alone or in combination, also fail to teach that the current emitter comprises sides and that "at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides," as amended independent claim 12 recites. Cathey '492 teaches that emitters 202a-202n are formed over substrate 200 and subjected to a hydrofluoric solution, and not that the current emitters 202a-202n comprise sides, "at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides," as in the claimed invention. Jones teaches that crystalline pyramidal tips 15 are "formed on top of elongated vertical columns rather than on the substrate itself" (col. 5, lines 35-38), and not that they have sides, at least a portion of which "being surrounded by an insulating layer to prevent current from radiating out of the sides," as in the claimed invention.

Second, to establish a *prima facie* case of obviousness, "[i]t is insufficient that the prior art disclosed the components of the patented device, either separately or used in other combinations; there must be some teaching, suggestion, or incentive to make the combination made by the inventor." Northern Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 934 (Fed. Cir. 1990). This way, "the inquiry is not whether each element existed in the prior art, but whether the prior art made obvious the invention as a whole for which patentability is claimed." Hartness Int'l, Inc. v. Simplimatic Engineering Co., 819 F.2d 1100, 1108 (Fed. Cir. 1987). Accordingly, a determination of obviousness "must involve more than indiscriminately combining prior art; a motivation or suggestion to combine must exist." Pro-Mold & Tool Co., 75 F.3d at 1573. This way, a rejection of a claim for obviousness in view of a combination of prior art references must be based on a showing of a suggestion, teaching, or motivation that has to be "clear and particular." In re Dembiczak, 175 F.3d at 999. Thus, the mere fact that it is possible to find two isolated

disclosures which might be combined to produce a new compound does not necessarily render such production obvious, unless the prior art also suggests the desirability of the proposed combination.

The February 4, 2004 Office Action fails to establish a *prima facie* case of obviousness because, as the Court in Northern Telecom, Inc. noted, "[i]t is insufficient that the prior art disclosed the components of the patented device" and there is no "teaching, suggestion, or incentive to make the combination." Northern Telecom, Inc., 908 F.2d at 934. On one hand, the crux of Cathey '492 is a wet chemical emitter tip treatment. For this, Cathey '492 teaches a "hydrogen termination" process for emitter tips 202a-202n that are subjected to a hydrofluoric acid solution formed by diluting the hydrofluoric acid with water "such that the ratio of water to acid is between about 1:1 to about 1000:1." (Col. 2, lines 32-35). On the other hand, the crux of Jones is the formation of current emitter tips 15a-15d over a substrate 11 by either a "tips first" method or a "columns first" method. For this, Jones teaches multiple processing steps at the end of which oxide layer 33 and extraction electrode 18 are formed next to the emitter tips 15a-15d. (Col. 7, lines 17-27; Figures 4G-4H). In fact, Jones specifically emphasizes that selecting the oxide layer material to etch slowly relative to silicon dioxide "permits removal of oxide from the silicon tip 15 without undercutting the extraction electrode 18." (Col. 7, lines 24-26). Accordingly, a person of ordinary skill in the art would not have been motivated to combine Cathey '492, which teaches a hydrofluoric acid solution for treating emitter tips, with Jones, which teaches "tips first" or "columns first" methods during which protection of structures adjacent to the emitter tips is important to the fabrication process. For at least these reasons, the Office Action fails to establish a prima facie case of obviousness and withdrawal of the rejection of claims 12, 18 and 19 is respectfully requested.

Claims 13-17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cathey '492 in view of Jones and further in view of Yamazaki (U.S. Patent No. 5,840,118) ("Yamazaki"). This rejection is respectfully traversed.

Yamazaki relates to "an effective method of annealing a semiconductor film by irradiation with a laser light." (Abstract). According to Yamazaki, "[t]his method consists of irradiating an amorphous silicon film 102 formed on a glass substrate 110 with a linear laser light 100 which is relatively scanned in the direction of arrow 109." (Abstract). Yamazaki also teaches that "[t]he area which will soon be or has just been irradiated with a laser light is heated by heaters 105 and 106" so that "[i]rradiation . . . crystallizes the amorphous silicon film 102 without abrupt phase change which otherwise occurs due to laser light irradiation." (Abstract).

The subject matter of claims 13-17 would not have been obvious over Cathey '492, Jones and Yamazaki, whether considered alone or in combination. Again, the Office Action fails to establish a *prima facie* case of obviousness. As noted above, Cathey '492 and Jones, considered alone or in combination, fail to teach or suggest all limitations of amended independent claim 12. Similarly, Yamazaki is silent about a "field emission display device," much less about "a treated current emission surface having an atomic concentration of oxygen resulting from treatment of the current emission surface with a plasma enhanced chemical vapor deposition hydrogenation process in the presence of a silane gas followed by a nitrogen infusion process," as amended independent claim 12 recites. Yamazaki teaches a "method for forming a crystalline silicon film on a substrate without causing thermal damage to it by laser light irradiation (col. 2, lines 7-10, and not the limitations of the claimed invention. Yamazaki is also silent about the atomic concentration of oxygen as being "smaller than the atomic concentration of oxygen of the current emitter subjected to atmospheric conditions" or about the "current emitter further comprising sides, at least a portion of said sides being surrounded by an insulating layer to prevent current from radiating out of the sides," as in the claimed invention.

In addition, a person of ordinary skill in the art would not have been motivated to combine Cathey '492, Jones and Yamazaki, as the Office Action asserts. On one hand, the crux of Cathey '492 is a wet chemical treatment for emitter tips 202a-202n that are subjected to a hydrofluoric acid solution. The crux of Jones is the formation of current

emitter tips 15a-15d over a substrate 11 by either a "tips first" method or a "columns first" method. On the other hand, the crux of Yamazaki is annealing a semiconductor film by irradiation with a laser light. Accordingly, the only element which Cathey '492, Jones and Yamazaki have in common is the substrate on which their respective structures are formed. Thus, a person of ordinary skill in the art would not have been motivated to combine these disparate references. For at least these reasons, the Office Action fails to establish a prima facie case of obviousness and withdrawal of the rejection of claims 13-17 is also respectfully requested.

Claims 20-23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cathey '492 in view of Jones and further in view of Cathey et al. (U.S. Patent No. 6,020,683) ("Cathey '683"). This rejection is respectfully traversed.

Cathey '683 relates to a "method for fabricating a field emission display (FED) with improved junction leakage characteristics." (Abstract). According to Cathey '683, "[t]he method includes the formation of a light blocking element between a cathodoluminescent display screen of the FED and semiconductor junctions formed on a baseplate of the FED." (Abstract). Cathey '683 teaches that "[t]he light blocking element protects the junctions from light formed at the display screen and light generated in the environment striking the junctions" so that "[e]lectrical characteristics of the junctions thus remain constant and junction leakage is improved." (Abstract).

The subject matter of claims 20-23 would not have been obvious over Cathey '492, Jones and Cathey '683, whether considered alone or in combination. Again, the Office Action fails to establish a *prima facie* case of obviousness. As noted above, Cathey '492 and Jones, considered alone or in combination, fail to teach or suggest all limitations of amended independent claim 12. Similarly, Cathey '683 is silent about all limitations of amended independent claim 12. The crux of Cathey '683 is the formation of "light blocking layer 64 . . . on the baseplate 70" to prevent "light from the environment and light generated at the display screen 48 from striking semiconductor junctions, such as the

junction formed by the N-type conductivity region 58, on the substrate 36." (Col. 5, lines 27-32).

Applicant also notes that, again, a person of ordinary skill in the art would not have been motivated to combine Cathey '492, Jones and Cathey '683, as the Office Action asserts. On one hand, the crux of Cathey '492 is a wet chemical treatment for emitter tips 202a-202n that are subjected to a hydrofluoric acid solution. The crux of Jones is the formation of current emitter tips 15a-15d over a substrate 11 by either a "tips first" method or a "columns first" method. On the other hand, the crux of Cathey '683 is formation of "light blocking layer 64 . . . on the baseplate 70" to prevent "light from the environment and light generated at the display screen 48 from striking semiconductor junctions. Thus, a person of ordinary skill in the art would not have been motivated to combine these disparate references. For at least these reasons, the Office Action fails to establish a prima facie case of obviousness and withdrawal of the rejection of claims 20-23 is also respectfully requested.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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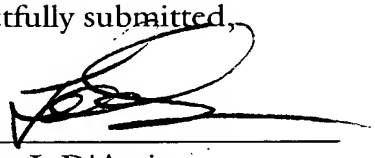
Respectfully submitted,



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